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DESCRIPTIONS OF SOME NEW NORTH AMERICAN CHALCIDIDÆ.

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Sub-family ENTEDONINÆ.

Astichus Forster.

(1) *Astichus arizonensis* n. sp.

♂. Length .04 inch. Steel blue, finely scaly, with a slight metallic tinge on thorax; the knees and tarsi white. Antennæ dark blue, the funicle joints excised, pedunculated, with whorls of very long hairs. Wings hyaline; veins pale, the marginal vein very long.

Hab.—Arizona.

Holcopelte Forster.

(2) *Holcopelte missouriensis* n. sp.

♀. Length .09 inch. Rather robust. Vertex of head, thorax and metathorax cupreous; face, thorax beneath and at sides, and the abdomen all blue. The scape of the antennæ, excepting at tip, and all the legs, excluding the blue coxæ, waxy white; flagellum blue-black, pilose. The head is punctate, thorax and scutellum scaly, the latter longer than wide with a median groove; metathorax with two delicate parallel keels. Abdomen petiolate, truncately rounded at apex, the second segment occupying most of its surface. Wings hyaline; veins pale brown.

Hab.—Missouri.

(3) *Holcopelte Popenoei* n. sp.

♀. Length .09 inch. All of the head, the thorax, mesopleura and coxæ bright cupreous. Head and thorax punctate; scutellum delicately scaly with a median groove. The scape of antennæ, excepting at tip, and legs yellowish white; flagellum cupreous. Abdomen as in *H.*

missouriensis, blue-black, with a slight æneous tinge near the base, in certain lights. Wings hyaline; veins pale.

Hab.—Kansas. Prof. E. A. Popenoe.

Both of the above species seem to approach quite closely to *H. albipes* Prov.

(4) *Holcopelte floridana* n. sp.

♀. Length .08 inch. All black, shining, excepting a slight æneous tinge on thorax. The trochanters, apices of femora, all tibiæ and tarsi, white. The head and thorax very delicately punctate; scutellum smooth with a median groove. Abdomen petiolate, pointed ovate, the second segment occupying most of its surface, the following segments short, but all distinctly visible. Wings hyaline; veins brown.

Hab.—Florida.

(5) *Holcopelte microgaster* n. sp.

♂. Length .05 inch. Blue-black, smooth. Scape of antennæ, coxæ and metathorax, distinctly blue. Funicle æneous. The femora, excepting tips, blue; tibiæ and tarsi white, the former with a brown blotch. Wings hyaline; veins yellow.

Hab.—Missouri.

Reared from a *Microgaster* cocoon.

Pleurotropis Forster.

(6) *Pleurotropis leucopus* n. sp.

♀. Length .06 inch. Robust, coarsely scaly. Dark blue, excepting a slight metallic tinge on the thorax; the apical tips of tibiæ and all tarsi white. Metathorax short, with delicate keels. Abdomen broadly oval, the petiole very short, second and third abdominal segments nearly equal, the following segments shorter. Wings hyaline; veins pale yellowish, postmarginal vein wanting.

Hab.—Florida.

Entedon Dalman.

(7) *Entedon albitarsis* n. sp.

♂. ♀. Length .06 to .08 inch. Head, antennæ and thorax, blue-black, vertex of head and mesothorax, æneous, distinctly scaly. Abdomen of female pointed ovate, in male linear; it, as well as the legs steel

blue; tips of tibiae and tarsi yellowish-white. Wings hyaline; veins pale brown.

Hab.—Virginia.

(8) *Entedon arizonensis* n. sp.

♀. Length .10 inch. Head, antennae and thorax, fiery cupreous. Head nearly smooth, vertex narrow; thorax and scutellum very coarsely scaly. Abdomen ovate, black, very highly polished, the second segment occupying nearly the whole surface. Legs blue-black, the anterior and middle pairs with metallic tinges, the posterior pair all cupreous. Wings hyaline; veins dark brown.

Hab.—Arizona.

(9) *Entedon columbiana* n. sp.

♀. Length .07 inch. This species is very close to *E. albitarsis*, and may prove to be nothing but a variety of that species. It differs, however, in being much more robust, more coarsely punctate and in having the trochanters, extreme tips of femora, all white, as well as the tarsi, characters that will readily separate the species.

Hab.—District of Columbia.

Asecodes Forster.

(10) *Asecodes albitarsis* n. sp.

♀. Length .08 inch. Blue-black, smooth, shining. Head and thorax with a decided brassy tinge. Scutellum smooth, metallic green. Antennae (?) seven-jointed, scape blue, flagellum metallic green, pilose. Legs, excepting the three basal joints of tarsi which are white, all blue or black. Wings hyaline; veins brown, the postmarginal vein is slightly developed.

Hab.—(?)

Omphale Haliday.

(11) *Omphale bicinctus* n. sp.

♂. Length .09 inch. Stout, robust, cyaneous, delicately ripple marked. Head large, broader than the thorax. Eyes very large, brown. Antennae inserted low down on the face; scape slender, yellow, excepting a dusky streak above near the apex; joints of flagellum black, with long hairs. Legs, excepting coxae and femora which are black, all yellow. Abdomen pointed ovate, slightly longer than the thorax, the second

segment the longest, but extending hardly to half the length of the abdomen; sides with some long hairs. Wings hyaline, with two transverse brown bands across the disk; veins pale brownish, the postmarginal vein longer than the stigmal.

Hab.—Florida.

Closterocerus Westwood.

(12) *Closterocerus cinctipennis* n. sp.

♂. Length .04 inch. Head, pleura, sternum, metathorax and abdomen blue; collar, mesothorax and scutellum golden green, strongly punctate. Head emarginate in front and consequently very thin antero-posteriorly. Antennæ brown-black, hairy. Legs brown, trochanters, tips of tibiæ and tarsi pale or whitish. Wings hyaline, fringed with long hairs, forewings with a brown band extending across the stigmal region and another at the apical margin.

Hab.—U. S.

Sub-family TETRASTICHINÆ.

Anozus Forster.

(13) *Anozus siphonophoræ* n. sp.

♀. Length .04 inch. Black, smooth, shining, impunctured. Head transverse, very thin antero-posteriorly, front deeply emarginated. Antennæ black, (broken). Thorax transverse, collar not visible from above; mesothorax broader than long, parapsidal furrows, deep; scutellum large, smooth, convex, without grooves, broad at base, the scapulæ being very minute; metathorax short; pleura blue-black. Abdomen sessile ovate, yellowish at base. All coxæ black; trochanters, tips of femora and tibiæ, and all tarsi, yellowish. Wings hyaline; veins pale brown, the marginal vein is very thick and about as long as the submarginal, the stigmal and postmarginal veins not developed, wanting.

Described from one specimen reared from an *Aphis*, *siphonophera* sp.

Euderus Haliday.

(14) *Euderus columbiana* n. sp.

♀. Length .10 inch. Dull brown, or bronzy green, its whole surface including the abdomen strongly confluent punctate. Head transverse, not wider than the posterior part of mesothorax and with only a slight antennal groove in front. Antennæ about as long as the thorax,

eight jointed; scape slender, yellowish brown; flagellum dark brown, about twice as long as the scape, pubescent, the pedicel shorter than the first funicle joint, the latter joint the longest, about twice as long as wide, the following joints being not much longer than wide, sub-moniliform. Thorax: collar transverse, rounded before; mesothorax with parapsidal grooves well defined; scutellum longer than wide, without grooves, rounded behind, sides parallel. Abdomen conic ovate, cylindric, one-third longer than head and thorax together, the segments of nearly equal length. Legs dark brown, trochanters, knees, fore and middle tibiae, and all the tarsi honey-yellow, hind tibiae dusky in the middle. Wings hyaline, fringed with short ciliae; the veins brown, the marginal is twice the length of the submarginal, the stigmal short, while the postmarginal is wanting.

Hab.—Florida and District of Columbia.

Hyperteles Forster.

(15) *Hyperteles hylotomæ* n. sp.

♀. Length .08 inch. Dark blue, with a faint metallic lustre on thorax. Antennae eight-jointed, brown, pubescent, scape brownish-yellow, the joints of the flagellum are about twice as long as thick. Collar transverse, rounded before; mesothorax with a median groove; scutellum with two parallel grooves; metathorax with three keels. Abdomen oval-rotund. Legs pale brownish-yellow, excepting the femora, which are blue for two-thirds their length; tarsi pale. Wings hyaline, pubescent, veins pale brown, the marginal vein about twice the length of the submarginal, stigmal vein longer than usual, postmarginal wanting.

Hab.—Canada.

Described from three specimens sent to me by Mr. W. Hague Harrington, who reared them from the eggs of a saw-fly *Hylotoma* sp.

Aprostocetus Westwood.

(16) *Aprostocetus granulatus* n. sp.

♀. Length .07 inch. Black, with a coarse, scaly punctation. Antennae, including scape, brown, pubescent. Thorax ovoid, the parapsides distinct, the collar very short, rounded before, the scutellum longer than wide with two grooves on its disk. The abdomen is pointed ovate, longer than head and thorax together, depressed above, rounded below, with an exerted ovipositor, nearly half its length. Legs dark honey-

yellow, femora and the tibiae at base brownish. Wings hyaline, pubescent and ciliated, the pubescence brown, the venation as in *Tetrastichus*.

Hab.—Florida.

Described from one specimen.

(17) *Aprostocetus canadensis* n. sp.

♀. Length to tip of ovipositor .08 inch; ovipositor .02 inch. Dark blue, with a slight æneous tinge on the thorax. Head emarginated in front, and very thin antero-posteriorly. Eyes brown. Antennæ short, eight-jointed, brown, pilose. Collar short, transverse, rounded before; mesothorax with distinct, deep parapsidal grooves and a median groove. Abomen linear not quite twice as long as the thorax, concave above, keeled below, the ovipositor being not quite two-thirds as long as the abdomen. Legs honey-yellow, the femora, excepting at tips, blue; the tibiae with a brown blotch in the middle, more distinct on the posterior pair; apical tarsal joints brownish. Wings hyaline, almost devoid of pubescence; the venation as in the genus *Tetrastichus*.

Hab.—Canada.

Described from two specimens sent me by Mr. W. Hague Harrington, who reared them from the thistle (?) cecidomyia, along with *Solenotus Fletcheri*, on which it may be a secondary parasite and from which it is with difficulty distinguished. *Solenotus*, however, has a larger collar and very broad, thick fore femora and tibiae.

(18) *Aprostocetus americanus* n. sp.

♀. Length to tip of ovipositor .09 inch; length of ovipositor alone .03 inch. Smooth, shining black. Head emarginated in front and very thin antero-posteriorly. Antennæ eight-jointed, brown, the club wider than the funicle joints. Thorax: collar very short, transverse; parapsidal grooves deep, distinct and no median groove on the mesonotum. Scutellum convex, slightly longer than wide, with two parallel grooves on the disk. Abdomen sessile, long, linear, without the ovipositor about twice as long as the head and thorax together, very slightly widened just before apex and from thence acuminate and ending in a long ovipositor two-thirds its length, above depressed, below keeled with a few long hairs surrounding apex. Legs honey-yellow, the femora, excepting at tips, brown, the terminal joints of anterior and middle tarsi and the two

terminal joints of posterior tarsi, brown. Wings hyaline, with short ciliæ; venation as in *Tetrastichus*.

Hab.—U. S.

Sub-family TRICHOGRAMMINÆ.

Trichogramma Westwood.

(19) *Trichogramma acuminatum* n. sp.

Female, length .03; male, .02 inch. Honey-yellow; eyes purplish-brown; legs pale or white. The abdomen in the female is acuminate-ovate, about twice as long as the head and thorax combined, with a lateral and a ventral row of five or six brown spots. In the male the abdomen is obtuse behind, not longer than the head and thorax combined. Antennæ pilose. The wings are strongly ciliate, the fore pair broadly rounded with a dusky blotch beneath the stigma, the hind pair rather narrowed and pointed at apex.

Described from two female and one male specimens, reared from a corn-leaf, and probably parasitic on the eggs of some leaf miner.

(20) *Trichogramma nigrum*.

Female. Length .02 inch. Robust, black, polished. Antennæ short, stout, brown. Legs entirely white. The scutellum is rather high testaceous, the extreme tip white. The abdomen is sessile ovate, not longer than the head and thorax, its dorsum somewhat flat. Wings hyaline, as in *T. acuminatum* without, however, the small blotch beneath the stigma; veins brownish; tegulæ white.

Described from two specimens.

(21) *Trichogramma ceresarum* n. sp.

Female. Length nearly .04 inch. Reddish-yellow, rather slender. Eyes brown. Abdomen and posterior femora fuscous, the fore and middle femora pale brown; tibiæ and tarsi pale. The thorax is triangular in front; the abdomen not longer than the thorax but wider. Wings hyaline, as in *T. nigrum*, but with very strong violet reflections.

Described from two specimens reared from the eggs of the Membracid *Ceresa bubulus* Say.

PREPARATORY STAGES OF CATOCALA PALÆOGAMA, GUEN.

BY G. H. FRENCH, CARBONDALE, ILL.

Egg.—Diameter .04 inch, low conoidal, a prominent bulging ridge round the base of one half of a hundredth of an inch on each side, so that inside of this the egg is .03 inch; striated with 38 prominent longitudinal striæ, of which 12 reach the small micropyle, shallow transverse striæ; apex small, not depressed. Color dull, pale, brownish olive. Duration of this period not known, but at least 194 days.

Young Larva.—Length .12 inch, of the usual *Catocala* shape, loopers on account of the first and second pairs of pro-legs being small; pale brownish yellow, joints 5 and 6 dark, somewhat blackish, joints 7 and 8 whitish, 9 and 10 blackish again; a faint fine red line on each side of body, very short hairs from the pelifirous spots. Duration of this period three days.

After 1st Molt.—Length .20 inch. Color reniform pale whitish, slightly brown tinted, head darker, a red line on each side with a broken line above it and another below it, of the same color, on the ventre a round red spot on the middle of each joint. Duration of this period four days.

After 2nd Molt.—Length .28 inch. On the sides are four rather broad, dark reddish purple stripes, alternating with pale greenish ones, these dark stripes approaching on joint 2 so that there is here only a narrow dorsal light line, the upper line indistinct; from joint 2 the dorsum widens out in pale greenish so that in the middle of the body this color extends to the region of the subdorsum, its outer part containing the upper part of the lateral stripe which is here broken and of a purplish green color. The dorsum from joint 5 to 10 has in its centre a series of very narrow elliptical pale purplish green spots extending from the middle of each joint to the middle of the next one back. Pilifirous spots small and black, head mottled with irregular longitudinal purplish black and pale greenish markings, the purple on joint 2 being of the same color but a little paler on its back part. Ventre with spots of the same dark color in the centres of the joints; feet pale. Toward the close of this period the larvæ turn darker, many of them being as dark on the whole of the dorsum as on the thoracic segments at the beginning of the period, this color purplish black, with a fine whitish dorsal line; all of them

darker than at the beginning of the period. Duration of this period six days.

After 3rd Moul. —Length .85 inch. Marked very much as in the preceding stage, stripes and mottlings purplish black, this color enough paler in the middle of the body to be purple, and jet black at the extremities, the two blending into each other and arranged in fine longitudinal stripes, each of which has a paler centre but which is not so pale as the alternating whitish stripe; the dorsum paler than the sides. Piliferous spots more prominent, black, the very short hairs black; head striped with broken white lines as before; ventral spots prominent only on the middle joints; thoracic feet pale. The lateral fringe begins to show. Duration of this period three days.

After 4th Moul. —Length 1.20 inches. Striped with black very much as before, but each stripe composed of three indistinct lines, making the body pale on joints 5 to 8 and the anterior part of joint 9 and the posterior part of joint 10, the rest of the joints darker; the light shade is lilac tinted with a yellow tinge between the joints from the middle of the body back; joints 2 and 13 so dark as to obliterate the stripes. Head striped as before, but the dark is orange shading into black towards the mouth; legs orange; piliferous spots on the dorsum black with yellow at the base, the lateral ones yellow; the hairs on the dorsum black, on the sides and head pale yellowish; a black transverse patch on joint 9 between posterior pair of dorsal piliferous spots; eyes black; ventre pale yellow, a yellowish black spot in the middle of each joint; the substigmatal stripe not separable into lines but irregularly mottled. Duration of this period five days.

After 5th Moul. —Length 1.60 inches. Color pale purplish red mottled with black, in some more or less of a yellowish tint, rather distinctly arranged in five light and four dark stripes, the mottlings being thicker in the dark stripes, the pale stripes with darker centres, the outer edge of the pale being almost free from black but mottled in shades of red; the dorsal stripe with the dark in ellipses that have their broadest part between the joints; piliferous spots on joint 2 pale yellowish, almost white, tipped with black; those on joint 3 to 4 white; those on the dorsum of the other joints dark yellow, pale at base; those on the sides pale yellowish; the posterior pair of dorsals on joint 12 very much enlarged; all large and prominent, each with a short black hair; joint 9

has a dark patch on the posterior part of the dorsum. Head pale reddish, the same shade as the red ground color, marked with irregular longitudinal rows of white dots; feet pale red; ventre pale yellow with black centres to the joints, those at the anterior and posterior parts of the body small. At this time there is a distinct fringe of fleshy appendages on the sides.

Mature Larva.—Length 2.75 inches; cylindrical, tapering slightly to either extremity, with short lateral fringe. Marked as at the beginning of the period with seven longitudinal stripes from stigmata to stigmata, the lower dark one stigmal, below this the space to the fringe the same color as the dorsal stripe, making the nine stripes mentioned before. The stripes are very nearly the same color, the only difference being that the dark ones have a little more of the black mottling than the pale ones; the stripes are divided by narrower stripes or broad lines of the ground color, which is dull, pale, smoky red. The thoracic joints are a little darker than the others. Piliferous spots pale nankeen, the dorsal tipped with orange; the space between the posterior dorsals on joint 9 black, only a little elevated; the posterior pair on joint 12 about three times as large as the others; each tipped with a very short black hair. Head, the ground color striped with reddish white that consists of transversely elongated dots; feet the ground color; fringe white; ventre pale yellow, a black patch on each joint. Duration of this period seven days.

Chrysalis.—Length 1.10 inches, depth .35 inch, width .40 inch; cylindrical, tapering from joint 5 back; tongue and wing cases extending back to the posterior part of joint 5, tongue case as far back as wing case; abdominal joints moderately punctured, anterior part of each a little corrugated; head moderately rounded. Color chestnut brown, covered with a white powder as is usual. Duration of this period from 30 to 32 days.

In pupating, the larva fastened leaves together with silk, slightly lining the interior, and into this thin lining the cremaster was fastened.

Food plant hickory.

The eggs from which the larvæ from which these notes were taken were found Oct. 5, 1886, in a crevice in a piece of hickory bark, there being fifty-eight of them in a mass, laid so that they overlapped each other, one edge of each being against the bark. I have since found the shells of other eggs in the crevices of hickory bark deposited in the

same way. The species of hickory upon which they were found was what is known as the Mockernut, or *Carya Tomentosa*.

The eggs hatched, or about one-fifth of them, April 17th, 1887, the rest coming out from day to day after this, and they emerged from the pupæ from June 14th to 16th, giving an egg period as above of at least 194 days, to which it is probable that at least two weeks more should be added; and from the time of hatching to the emergence of the imagines 58 days, of which one month is in the pupa state. I have no reason to think that this, or any other species we have here, is more than one brooded. I am also of the opinion that they pass through changes sooner in the hatching boxes than in their homes in the woods, as I never find this species on the trees before July; and the same may be said of some other species, though *C. Ilea* should probably be excepted.

After one had moulted, at the last moult, I saw it turn, after its usual period of rest, and eat the cast off skin.

THREE MOTHS NEW TO OUR FAUNA.

BY HY. EDWARDS.

In my article with the above heading, to which my friend Mr. J. B. Smith takes exception, I at once confess that an error occurs, and that the title should have been new to "our lists" and not to "our fauna." Mr. Smith wrote me a day or two after the publication of the paper, and I at once replied that I should have used the word "lists" in the place of "fauna." I am therefore somewhat surprised that in his printed remarks he did not allude to the correction I had personally made, but that he should take me to task *after* receiving my letter, and charge me with adding the species mentioned to our "fauna," when I had disclaimed the meaning he attributes to me. But though I am free to allow that the species I spoke of may not with propriety belong to the U. S. fauna, I am by no means willing to admit that they are on that account not deserving of a place in our Check List or Catalogue. This is, as I take it, not a philosophic account of species belonging to a certain faunal district, but merely the names of those species found to be inhabiting a geographical limit, and is intended chiefly for the purpose of enabling collectors and

students to classify their specimens, and in the case of a synonymical catalogue, of referring to the descriptions of species. At any rate, this is the view I take in giving *Pseudosph. Tetrio*, *Philamp. Typhon* and *Syntom. Epilaris* as being found within our limits, and I hold that they have as much right to a place among N. American, or rather United States species as many that have long been admitted. Of the first named, I have now seen five examples, four taken in Arizona, and one in N. W. Texas. Of these, one was quite fresh and in excellent condition, the others more or less broken and imperfect, though apparently more from careless handling than from either long flight or the age of the specimens. I cannot of course say positively that the species breeds in U. S. territory, but I have as much ground for believing that it *does*, as my friend Smith has for assuming that it *does not*. Then as to *P. Typhon*. The specimen to which I allude was taken by the late Mr. H. K. Morrison in the mountains of N. E. Arizona, as nearly as I can tell, about 200 miles from the boundary line. It is quite perfect, so much so that it may only have emerged from the pupa state within two days, and it seems to me hardly credible that this particular example should have flown such a great distance, and still retain in their purity all its delicate scales. *Syntomeida Epilaris* is from Florida, and I have very little doubt that it will one day be found there in comparative plenty. Indeed, I have good reason to believe that it was taken by Mr. Morrison a short time before his death, and it may possibly be among the Lepidoptera found by Mr. Schwartz during his visit to Key West some little time ago. If we are to discard these insects from our lists because our territory is not their original home, what will become of a large number of the species now included? One third at least of those from Florida, Texas, Arizona and S. California will have to be eliminated, for at least this proportion must be said to belong to a different fauna from the insects of Pennsylvania or Illinois. Mr. Smith calls attention to the fact that he has excluded *Diludia Brontes* from his monograph of the Sphingidæ. I still fail to see on what grounds. *D. Brontes* is found in Florida, and specimens taken by Dr. Wittfeld are in my collection and in that of Mr. Neumoegen. If these insects did not breed near Indian River, where did they come from? Surely Mr. Smith would hardly have us believe that they flew across the ocean from Cuba. I am no believer in the frequent long flight of any species of insects, though it is known that many species travel considerable distances, but I cannot bring myself to think that a specimen say of *D. Brontes* flies from its home in Cuba,

and that months or a year after two or three more do the same thing, and that these all find their way to Dr. Wittfeld's collecting box. As my friend W. J. Florence would say, this is T. T. (too thin). It seems more reasonable to believe, as I honestly think is the case with the species in dispute, that a few individuals have established themselves upon our limits, and that they are now gradually taking up new localities and spreading over a larger area. Mr. Smith alludes to *Erebus Odora*, and says that "because it has been found in Canada, it would be an absurdity to call it a Canadian insect." Now I think he is unfortunate in this statement. We do not yet know the food plant of the larva of this species, but because we are ignorant of that, it is no reason why it should not breed in Canada, and the evidence is in favor of its doing so. I have examined at least forty specimens of *E. Odora*, taken severally in New York, Georgia, Arizona, California, Vanc. Island, Canada, Michigan, Illinois and Ohio, some of them in absolutely perfect condition, and as fresh as bred specimens, and I am in my own mind quite sure that this species at least has taken up its abode with us, and is as much a resident of the U. S. as *Vanessa Antiopa* or *Pyrameis Cardui*. As to Mr. W. H. Edwards having "separately called attention to species occasionally found in but not really belonging to our fauna," I respectfully submit that this is a mistake. Mr. Edwards has done nothing of the kind. He has *discarded* from his Catalogue a number of "species for some time accredited to our fauna, but omitted for want of authentication," which is but saying in other words that had the statement of the capture of the species within our limits been given on undoubted authority, they would have found their place in his Catalogue. He has included indeed *Parnassius Eversmanni*, *Callidryas Philea*, *Diadema Misippus*, and others, which certainly are not parts of our fauna, but Mr. Edwards holds the same views as I do on the subject, and I claim no more for the three species I alluded to than is claimed for the diurnals I have just mentioned, and that is; that they have been found within our limits, that there is no evidence before us to show that they do not breed therein, and that therefore, when I change, as I am willing to do, the heading of my article to "our lists" in the place of "our fauna," the three species to which I called attention should be recorded in our catalogues.

THE ORIGIN OF ORNAMENTATION IN THE LEPIDOPTERA.

BY A. R. GROTE, A. M., BREMEN, GERMANY.

Elsewhere I have ventured to call attention to the interesting chapter in Mr. Scudder's book on Butterflies, in which the theory as to the primitive pattern of ornamentation is given. By this we are told that the complex patterns, the seemingly chiselled lines and the eye-like spots, arose from simple transverse shade bands running parallel to the outer margins of the wings themselves. Such bands we yet find on the wings of many Owlet Moths. In the Moths we might expect to find, still existing, a nearer approach to the primitive style of marking than in the higher Butterflies. Mr. Scudder's theory of the primitive pattern is quite independent of the theory as to the origin of the primitive transverse shade lines themselves. Referring to what I have said in my "Essay on the Noctuidæ" and in other places, about the pattern of one wing being reproduced in some species exactly, and in some whole families in the style of a rougher copy, upon the under-lying wing, I have employed the word "photographed" to express the effect produced. The primitive band may then be conceived to have been produced by an *outside* process, the effect of light and shade upon the surface of the wing itself. Its production may have been aided by the movement of the wings (expanding and shutting). The edges of the wings in many ways may be conceived to be first affected. That the primitive Lepidopteron was plain and sombre, we have reason to suppose, judging from what is known of now extinct types from which the whole Order may have been evolved. Under the murky skies of the Carboniferous the colors of the insects remained dull. Upon this plain wing, the first shade or marking may have arisen by a process comparable with 'photography, the action being produced by the same chemically acting ray of light. The atmospheric conditions then existing are factors in the problem. The shadow originally cast on the wing left a trace in process of time, a deeper tinting which became a permanent shade line or band. The evolution of this primitive shade band is the subject of Mr. Scudder's theory. The manner in which it may have arisen from a shadow has been long the subject of my own thoughts. I am aware that there is a learned opinion that the colors and patterns of insects are developed from the insects' insides, by a process the links in which I am unable to follow, and which it has not pleased the authors of this

inside theory to state. It seems more reasonable to conclude that the sun has been the original painter, still improving and beautifying his work. That the deviations from the original pattern and color have been seized upon by Natural Selection and that gradual changes have been fostered, may be conceived under the workings of general evolutionary law.

From a study of the subreniform spot in *Catocala*, I, many years ago, came to the conclusion that the spots in the *Noctuidæ* were modifications of the transverse lines, and this theory will be found stated in my writings. They may be fragments of original transverse lines, or, as the case seems to be with the subreniform spots, they may belong to existing transverse lines from which they have become disconnected. The median transverse shade is interesting, as it still simulates, by its cloudiness, the shade band of the secondaries and of the under surface of both wings in most *Noctuidæ nonfasciatæ* or *Noctuina*. The primitive transverse shade band will have been vague and cloudy, and all fine and cleanly cut markings will prove to be recent in comparison and to have proceeded from nebulous and undefined ornamentation.

The instances where the upper surface of the secondaries resemble the under surface of the primaries occur in the *Ceratocampina*, and also in the *Smerinthina*, among other groups. This fact struck me when I was studying the relationship between the Horned Spinners and the Eyed Hawk Moths. As a general rule, the cloudy bands on the under surface of the wings of the *Noctuidæ* or Owlet Moths, resemble those on the hind wings above. The under, or covered wing, bears a certain relationship to the upper, or covering wing, in coloring and ornamentation. We may conclude that it has remained longer plain and unicolorous, that its less exposure in certain groups of the *Lepidoptera* has allowed it to retain more of the primitive appearance. The Spanners, or *Geometridæ*, the Sparklers, or *Pyralidæ*, carry the under wings more exposed and the markings are continuous and similar on both wings above. This is the case with the lower or geometridous *Noctuidæ*, to a considerable extent. The pattern of the wings seems to follow the exposure, as I have elsewhere pointed out. The conditions of the caterpillar stages are widely different from the environment of the perfect insect, and I have long ago pointed out that each stage varies independently and unequally, as in the case of the representative species of *Apatela*, etc., (see my paper in *Annals N. Y. Lyceum*, N. H.) I have also elsewhere drawn attention to

the law of variation in representative species in the Owlet Moths. This variation is first observed on the upper surface of the fore wings, then of hind wings, while the whole under surface preserves its similarity longest. The uniformity of the under surface in the Noctuidæ seems to be correlated with the habits of the insects themselves, to depend, in fact, upon the conditions of its exposure to the light. I am not here arguing that color in the wings is now dependent upon existing conditions of light. I merely point out that variation both in color and marking proceeds apparently more noticeably upon the more exposed surfaces of the insect in the Noctuidæ, from a comparison of related species inhabiting different parts of the world. In the history of the Lepidoptera former geological conditions have played a part in the evolution of species together with the whole environment. In this paper I merely show the probability that the first transverse markings were the effect of light, and that the more exposed surfaces show most variation in representative species. From my scattered writings I have in part brought these brief notices on this point here together, so that the student may be spared that trouble, and in the hope that the investigation may be carried further.

In the investigation of this subject we must keep the phenomena of color and pattern separate. The test of our theories must lie in the observation of existing variations. In this direction the observations of Mr. Edwards on the influence of cold in the pupa state upon the colors of the imago, are of the utmost value. The class of facts bearing upon the phylogeny of the species must be kept separate from those bearing upon individual variation. But it must be remembered that varieties are in the same sense evanescent species, that species are permanent varieties. The crucial test of our modern idea of species lies in the demonstration of the fact that, in the whole life history, the cycle of reproduction is *now* distinct. To the establishing of this fact repeated observations are often necessary. The whole conditions under which the form is produced must be understood. This is a great field of work, and single instances, however carefully recorded, of breeding from the larva, only partially illustrate the subject. The value of specific determinations from collections of perfect insects depends on the tact and experience of the naturalist and are to this extent tentative. Only where the full round of insect life is known can our determinations be absolutely reliable. The vista of entomological labor is widening as we proceed, so that it is trite to say that the subject

is inexhaustible. The most attractive side of the study consists in the curious habits and relationships of the different forms, and here is where the talent of the observer is to be tested. The assorting of collections of specimens is a matter of subordinate tact.

CEYLON BUTTERFLIES.

The Lepidoptera of Ceylon, by F. Moore, F. Z. S., Vol. I., (published under the special patronage of the Government of Ceylon) London, L. Reeve & Co., 1880-81. 4°.

The butterflies of the East India region appear to be now in a fair way of receiving their due share of attention. We have already called attention to Distant's invaluable work on the Malayan butterflies, and to the handbook to the butterflies of India and Burmah, by Marshall and De Nicéville. On many accounts neither of these is so important as the earlier work on the Lepidoptera of Ceylon by Frederick Moore, which we desire to introduce to the readers of the CANADIAN ENTOMOLOGIST, principally on account of the very considerable accession to our knowledge of the earlier stages of eastern butterflies which is here given in the plates, and also to draw attention to the notes on the natural history of the insects given by Dr. Thwaites, which are embodied in the text. The work as a whole consists of three volumes; but we speak here of the butterflies only, which are comprised in the first volume, published in 1880-81. It is a large quarto, with 71 excellent colored plates, in which the early stages are in very many instances figured side by side with the butterflies. Notwithstanding that it is published under the special patronage of the Government of Ceylon, the work is a costly one, and to one residing in the United States an embargo is laid upon its purchase by the fact that the duties upon such a work are so high. This single volume cost me \$15 for duties and transportation alone. Thus is science encouraged with us!

We are here introduced to a new set of illustrations of the early stages of butterflies, many of which are of extreme interest, and these in every family of butterflies. It is the most important and considerable contribution to our knowledge since Horsfield's memorable volume. It is a pity, however, that in many instances no reference is made in the text, either in Dr. Thwaites' notes, or Mr. Moore's descriptive portion, as to the meaning of certain figures which differ strikingly from those of their allies.

Thus the pupa of a species of *Cirrochroa* is represented as hanging by its hinder end, as in all *Nymphalidæ*, but bent so at the end of the abdomen as to lie parallel to the horizontal branch from which it is suspended, much in the way that we find it in our own species of *Chlorippe*; but there is no appearance in the figure and no mention in the text of any greatly elongated cremaster with its row of hooklets down the side, which in *Chlorippe* stiffens the pupa into what would seem to be an unnatural position. We have some interesting additions to our scanty knowledge of the early stages of the *Lemoniinae* and an unusual wealth of larvæ and pupæ of *Lycaeninae*. Here again is a figure of a species of *Spalgis* hanging by its tail without the median girt, which is wholly anomalous in this subfamily, but, as there is no explanation of the matter in the text, it is to be presumed that it is not meant to represent the insect in its natural position, the more so as the same is the case in a species of *Appias*, one of the *Pierinae*, represented in two figures as hanging by its tail only, while the whole structure of the chrysalis indicates that it must have had a median girt. Very interesting are the figures of the early stages of the *Papilioninae*, which add very considerably to our knowledge, including as they do some figures of the younger stages of the larva—presumably younger from their appendages, though here again no mention whatever is made of the fact in the text. We call attention also to the interesting figure of *Gangara*, a hesperian living open and unconcealed, as I am informed by Mr. De Nicéville, and which bears long waxy filaments apparently not proper appendages, but as long as the width of the body itself, rendering it an exceedingly conspicuous object.

In the arrangement of families, Mr. Moore follows the rapidly growing company of the best instructed entomologists in beginning the series with the *Nymphalidæ* and placing the *Papilionidæ* just before the *Hesperidæ*. He separates the *Lemoniinae* from the *Lycaeninae* as a distinct family, and places the *Libytheinae* with the *Lemoniinae* as was done by Bates; but he brings the *Pierinae* and the *Papilioninae* under one family heading. It has naturally pleased the present writer to see that Mr. Moore has had the courage of his convictions sufficiently to subdivide the old and bulky group so long holding rank as a homogeneous whole, the so-called genus *Papilio*, into a number of genera, including among the seventeen species which he catalogues no less than ten genera, following thus precisely the line which Hübner long ago undertook to establish, and which I adopted in 1872.

SAMUEL H. SCUDDER.

EARLY STAGES OF ARZAMA OBLIQUATA, G. AND R.

BY H. H. BREHME, NEWARK, N. J.

EGG.—Fusiform, thick in the middle and tapering to a small rounded summit, marked by about sixteen longitudinal ribs, which are low, narrow, flat and crossed by a few fine ridges. Color yellow-brown. Duration about fifteen days.

YOUNG LARVA.—About .8 inch in length, cylindrical, slender; shape like the other Arzamas. Color pale green, with a few long hairs proceeding backwards. Duration eighteen to twenty days.

MATURE LARVA.—When fully grown the larvæ are $1\frac{1}{2}$ inch in length, some as much as two inches long. They are very slender; head thick; color more gray; body smooth, with no hairs.

PUPA.—Length .75 inch; breadth across mesonotum .16 inch; across abdomen .16 inch; greatest depth .22 inches. Shape like the other Arzamas. Color dark brown. Duration sixteen days.

The eggs from which these observations were made were obtained on the 26th of October, 1886, by confining a dilapidated female caught flying about the food-plant—the Cat-tail reed. The female generally lays her eggs in the middle of the reed, between the long leaves. They began to hatch on the 10th of November, thus giving a period of about 15 days. They began to go into pupæ on the 20th April, 1887, making the whole larval period 161 days; adding to this the pupal period of 16 days, makes a total of 190 days from the egg to the imago.

The food-plant—the Cat-tail reed—grows in the meadows. As soon as the larva is hatched, it bores at once into the reed and feeds from the top downwards, continuing to feed throughout the winter, until the whole of the reed is eaten out; it then returns to the top, and forms its pupa there. The larva is very hard to rear, as it feeds during the winter, and the reed must be kept as wet as possible. I have succeeded by keeping the reeds in a pail of water.

The moth generally begins to fly between four and five o'clock in the afternoon, and ceases between seven and eight o'clock. Its flight is very slow. It is described and figured by Grote and Robinson, Trans. Am. Ent. Soc., vol. I., page 339.

CORRESPONDENCE.

ON INSECTS FEIGNING DEATH.

Dear Sir: I notice in Dr. Hamilton's paper, page 6, the remark that a statement made by me in your pages, namely, "that insects can have no knowledge of death," as such of course and purposely feigning it, is "unsupported" and "dogmatic." I wish to correct these two adjectives, otherwise, as a matter of opinion, I have no further interest with the subject. I cited in my paper the reason for my belief that insects merely kept still and did not move on the approach of danger. I showed that hard bodied insects, as beetles, suffered themselves to drop, while soft bodied caterpillars, equally assuming attitudes of repose and quiet, assisted by their colors and mimicry, clung tenaciously. There is no doubt in my mind that the "keeping still" is the main point, and that the insects have not sufficient mental powers to feign death. Whether insects can have any knowledge of death, as such, may be a matter of opinion, I should as soon credit them with a knowledge of history. Beetles allow themselves to fall by folding in the legs, knowing, from acquired or hereditary experience, that a fall will not hurt them, while in the grass where they tumble they have a place of concealment where they can stop "feigning" and scamper away. While I do not believe that insects can reach the "feigning" process, I know that Dr. Hamilton can, when he says of my paper, which we have all at least glanced over in the pages of the CANADIAN ENTOMOLOGIST, that he "lately saw it in print somewhere." Such carelessness is probably feigned, and whether it is protective may be doubted. It is, however, the privilege of man to keep still, without the danger of being credited with feigning death, a privilege it seems denied to insects. It is well so, since a silent man might run the risk of being buried on suspicion. A. R. GROTE.

NOTES ON COLEOPTERA.

Dear Sir: In my paper in the April No. of the ENTOMOLOGIST, page 66, last line, *Apion herculanum* is printed in error *herculaneum*. On same page I wrote "*prolongata* [Dicerca] breeds so far as known in conifers." This statement admits of a doubt, when the proof is sifted thoroughly. Mr. F. C. Bowditch writes that he collected it on the Colorado mountains on aspen and willow, but never on conifers. It is probably polyphagous, like some other species of this family.

JOHN HAMILTON.

